

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 9405wo/at/al	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/SE2003/002023	International filing date (day/month/year) 18-12-2003	Priority date (day/month/year) 20-12-2002
International Patent Classification (IPC) or national classification and IPC G01R 15/16, G01R 19/06		
Applicant ABB AB et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:

- a. ☒ (sent to the applicant and to the International Bureau) a total of 4 sheets, as follows:
 - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

- b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- ☒ Box No. I Basis of the report
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand 14-05-2004	Date of completion of this report 2005 04 12
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Form PCT/IPEA/409 (cover sheet) (January 2004)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE2003/002023

Box No. 1 Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

- ☐ This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1 - 18 _____ as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☒ the claims:
- pages _____ as originally filed/furnished
- pages* _____ as amended (together with any statement) under Article 19
- pages* 19 - 22 received by this Authority on 22 - 10 - 2004
- pages* _____ received by this Authority on _____
- ☒ the drawings:
- pages 1 - 4 _____ as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International Application No.

PCT/SE2003/002023

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-14</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-14</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-14</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The most relevant documents cited in the International Search Report:

D1: US4204152

D2: US3842344

D3: US4295094

D1 discloses a high voltage measuring apparatus. The voltage sensing device comprises a capacitor in series with resistances, a voltage divider through which the current is measured (figure 3, components 12, 27 and 35).

D2 describes a device for measuring the dielectric properties of insulators. The object is characterised by a capacitor in series with a resistance through which the current is measured and is used at high voltages.

D3 discloses a high voltage measuring system where optical transmission is used.

The invention according to the claims 1 and 8 discloses a device and a method for measuring voltage by sensing the capacitor current. It is considered as general common knowledge that the voltage over a capacitor is determined by its capacitance and the current through the capacitor. To use this technique is known from, for example, D1. However, to solve the problem that the measurement signal is subjected to the influence of capacitive parasitic currents as well as to resistive surface currents, the features of the voltage terminal and the screen is not anticipated by the cited documents.

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: BOX V

Accordingly, the invention defined in claims 1 and 8 is novel and is considered to involve an inventive step.

Claims 2-7 and 9-14 are dependent on claims 1 and 8 respectively, and as such they meet the requirements of the PCT with respect to novelty and inventive step.

The invention is industrially applicable.

AMENDED CLAIMS

1. Measuring equipment (4) for forming a measured value (V_u)
for voltage representing an ac voltage (U) on a high-voltage
5 conductor (1), said measuring equipment comprising capacitor
equipment (C41) with a known capacitance for connection be-
tween the high-voltage conductor (1) and ground potential
(E), **characterized** in that the capacitor equipment is in the
form of a coupling capacitor (C) with an external voltage
10 terminal (B41), that the capacitor equipment is arranged in
a support insulator, that the measuring equipment comprises
a screen (PS) of an electrically conductive material
surrounding said external voltage terminal, and that said
electrically conductive screen is electrically conductively
15 connected to the casing (N) of the support insulator and
that the measuring equipment further comprises current-
measuring means (41) for sensing a capacitor current (I_c)
flowing through the capacitor equipment and for forming the
measured value for voltage in dependence on said capacitor
20 current.

2. Measuring equipment according to claim 1, **characterized**
in that said current-measuring means comprises a resistor
(R41) for connection in series with the capacitor equipment,
25 the measured value for voltage (V_u) being formed in depen-
dence on a sensed voltage across the resistor representing
the capacitor current.

3. Measuring equipment according to claims 1 and 2,
30 **characterized** in that said current-measuring means comprises
a digital/optical measurement value transformer (43) for
transforming the measured value for voltage into a series of
light pulses (01) representing the measured value for volta-
ge.

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4. Measuring equipment according claim 3, **characterized** in that said resistor is connected between the high-voltage conductor and said external voltage terminal on the capacitor equipment and that, in addition thereto, it comprises
- 5 current-measuring means (42a, 42b) for forming a measured value for current (V_a , V_w) representing a line current (I) flowing through the high-voltage conductor.
5. Measuring equipment according claim 4, **characterized** in that the measured value for current is supplied to said
- 10 digital/optical measurement value transformer for transforming the measured value for current into a series of light pulses (O_1) representing the measured value for current.
- 15 6. Measuring equipment according claim 5, **characterized** in that the digital/optical measurement value transformer is arranged to sequentially transform said measured value for voltage and said measured value for current into series of
- 20 light pulses for sequential transmission to ground potential on a common optical transmission link.
7. Measuring equipment according any of claims 4-6, **characterized** in that said current-measuring means are moun-
- 25 ted on the top of said support insulator, and that said electrically conductive screen is electrically conductively connected to the casing (N) of the support insulator as well as to an electrically conductive part (M) on the current-measuring means that is located at the potential of the
- 30 high-voltage conductor but is electrically insulated from the external voltage terminal of the coupling capacitor.
8. A method for forming at least one measured value (V_u) for voltage, representing an ac voltage (U) on a high-voltage
- 35 conductor (1), wherein measuring equipment comprising capacitor equipment (C41) with a known capacitance is connected between the high-voltage conductor (1) and ground potential (E), **characterized** in that the capacitor equipment is

constituted by a coupling capacitor (C), and that the coupling capacitor is provided with an external voltage terminal (B41), and that the capacitor equipment is arranged in a support insulator (N), and that said measuring
5 equipment is provided with a screen (PS) of an electrically conductive material, surrounding said external voltage terminal and being electrically conductively connected to the casing (N) of the support insulator and that a capacitor current (I_c) flowing through the capacitor equipment is
10 sensed and that said measured value for voltage is formed in dependence on said capacitor current.

9. A method according to claim 8, **characterized** in that a resistor (R41) is connected in series with the high-voltage
15 conductor and the capacitor equipment and that said capacitor current (I_c) is sensed as a measured value (V_u) for voltage across the resistor.

10. A method according to any of claims 8 and 9,
20 **characterized** in that the measured value for voltage is supplied to a digital/optical measurement value transformer and that said the measured value for voltage is transformed into a series of light pulses (O1) representing the measured value for voltage.

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11. A method according to claim 10, **characterized** in that said resistor (R41) is connected between the high-voltage conductor and said external voltage terminal on the capacitor equipment, and that, in addition thereto, a current-
30 measuring means (42a, 42b) is connected to the measuring equipment, and that a measured value (V_a , V_w) for current, representing a line current (I) flowing through the high-voltage conductor, is sensed.

35 12. A method according to claim 11, **characterized** in that the measured value for current is supplied to a digital/-optical measurement value transformer, and that said measured value for current is transformed into a series of

light pulses (01) representing the measured value for current.

13. A method according to claim 12, **characterized** in that
5 said measured value for voltage and said measured value for current are transmitted sequentially to ground potential on a common optical transmission link.

14. A method according to any of claims 11-13, **characterized**
10 in that said current-measuring means is mounted on the top of said support insulator, and that said electrically conductive screen is electrically conductively connected to an electrically conductive part (M) on the current-measuring
15 means that is located at the potential of the high-voltage conductor but is electrically insulated from the external voltage terminal of the coupling capacitor, as well as to the casing (N) of the support insulator.

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